(19) Japanese Patent Office

(11) Publication Number
64-45195

(12) THE LAID-OPEN UTILITY MODEL GAZETTE (U)

(51)Int.Cl.[4]	Identification codes	Office File Numbers
D 06 M	11/00	Z-8521-4L
A 61 N	5/06	A-7831-4C
B 32 B	5/30	7016-4F
	18/00	6122-4F
	33/00	6122-4F
D 06 Q	1/00	7633-4L

(43) Publication date 17th March 1989

Request for Examination Not Received

(Total sheets)

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(54) Title of the utility model: A moisture-permeable waterproof fabric with heat insulation

(21) Application number: 62-137034 (137034-1987)

(22) Application date: 8th September 1987

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Specification

1. Title of the Utility Model

A moisture-permeable waterproof fabric with heat insulation

2. Scope of Claim

(1) A moisture-permeable waterproof fabric with heat-insulation, which is formed by evenly affixing, as dots, lines or combination of dots and lines, a ceramic powder-containing resin over the entire resin face of a moisture-permeable waterproof resin fabric which has a moisture-permeable waterproof resin film.

3. Detailed Description of the Utility Model

(Industrial Field of Application)

This utility model relates to a fabric formed by conferring heat insulation properties on a moisture-permeable waterproof fabric which simultaneously possesses the two functions of waterproofness and moisture permeability.

(Prior-Art)

Moisture-permeable waterproof fabrics comprising a cloth coated with a polyurethane resin or a polyamino acid urethane resin, and moisture-permeable waterproof fabrics comprising a polytetrafluoroethylene porous film laminated to a cloth, have been produced hitherto in great numbers, and they have been employed primarily as sports-related clothing.

These moisture-permeable waterproof fabrics are valuable in that, while water-vapour caused by perspiration from the body is released to the outside, the penetration of rain into the clothes is prevented. However, the heat insulating properties are inadequate, and this problem has been resolved, in for example ski clothes applications, by producing a two-layer construction with a heat-insulating backing or by a three-layer construction with a lining and a backing. However, in athletics applications, lightness is demanded along with close fitting to the skin, so it is not possible to employ this method for resolving the problem and, instead, there has been employed coating using a coating resin liquid to which aluminium powder or carbon powder has been added, or using a coating resin layer which itself has inherent heat insulating properties.

(Problem to be Resolved by the Invention)

However, with the aforesaid conventional methods, in the former case there is the disadvantage that, because of the multilayer construction with a heat-insulating backing and/or lining material, the fabric is heavy and bulky, so free movement is impeded, while in the latter case, although heat insulation is indeed obtained by the method of incorporating an aluminium powder or other such material into the coated resin layer, as a result of this mixing of an 'alien material' such as aluminium powder into the resin layer, there is the problem of a reduction in the resin layer film strength or in the adhesive strength to the base material.

The present utility model has been made in view of this situation and has the objective of offering a fabric which possesses moisture-permeability, waterproofness and adequate heat insulation and, furthermore, which does not impede free motion and has a resin layer of outstanding strength.

(Means for Resolving the Problem)

For attaining this objective the present utility model has the following construction.

Specifically, the essence of the present utility model lies in a moisture-permeable waterproof fabric with heat-insulating properties, which is formed by evenly affixing, as dots, lines or combination of dots and lines, a ceramic powder-containing resin over the entire resin face of a moisture-permeable waterproof resin fabric which has a moisture-permeable waterproof resin film.

Below, this utility model is explained in detail. Reference to a ceramic powder here means a ceramic having a far-infrared ray radiating capacity, such as titanium, silicon, chromium, zirconium, iron or copper oxide, silicon, boron, zirconium or tantalum carbide, or crystalline materials such as mica, fluorite, calcite and the like.

The aforesaid ceramics can be employed on their own but preferably they are used mixed-together so as to provide a useful far infrared ray radiating capacity in terms of the human body in the ambient temperature region.

The powder employed in this utility model is powder which has been pulverized to a particle size of no more than 100 μm, and more preferably it is a fine powder of particle size no more than 10 μm. If the powder is too large in size, then it is difficult to affix to the resin face of the moisture-permeable waterproof fabric described below, and even when it can be affixed it produces a harsh handle.

The resin containing the ceramic powder may be a generally-known resin but, normally, since the resin layer of the moisture-permeable waterproof fabric is polyurethane, polyamino acid urethane, polytetrafluoroethylene or the like, there is advantageously employed a two-liquid reactive type urethane resin or a water-soluble or emulsion type polyurethane resin. The moisture-permeable waterproof fabric is a fabric which simultaneously possesses waterproofness and moisture permeability, and it is obtained by forming a waterproof moisture-permeable film of, for example, polyurethane resin, polyamino acid urethane resin, polytetrafluoroethylene resin or acrylate ester resin at the surface of a woven or knitted material of nylon, polyester, acrylic, rayon, cotton or the like, by coating or by laminating.

Generally speaking, the moisture permeability of the resin containing the ceramic powder is lower than the moisture permeability of the resin used on the moisture-permeable waterproof fabric, so when the ceramic powder-containing resin is affixed to the resin face of the moisture-permeable waterproof fabric, the moisture permeability is reduced. Hence, it is advantageous if a polyamino acid urethane resin of high inherent moisture

permeability be used as the resin on the moisture-permeable waterproof fabric.

Practical examples of the form in which the ceramic powder-containing resin is affixed over the entire face of the moisture-permeable waterproof fabric are now explained by means of the drawings.

Figures 1 to 3 show the state of application of the ceramic powder-containing resin on the resin face of the moisture-permeable waterproof fabric in the form of dots; Figures 4 to 7 show the same in the form of lines; and Figures 8 and 9 show the same in the form of a combination of dots and lines. As examples of the dots, Figures 1 to 3 show round-shaped, square-shaped and star-shaped dots but other shapes of dots are also possible and the area of each dot and the number thereof are not restricted to the particular examples shown. In the same way, Figures 4 to 7 show straight lines and curved lines of the same width as examples of lines, but the lines may also have other forms and the respective lines need not have the same width.

Figures 8 and 9 show combinations of dots and lines but there is no restriction to these combinations.

As the method for uniformly affixing the ceramic powder-containing resin over the entire resin face of the moisture-permeable waterproof fabric, there can be used flat-plate or rotary screen coating or gravure coating, with selection being made according to the suitability of the ceramic powder-containing resin.

The coated area of the ceramic powder-containing resin is preferably no more than 50% of the resin area of the moisture-permeable waterproof fabric. If the area is too great, the moisture-permeability of the fabric is impaired, while if it is too small then the heat insulation is too low.

In accordance with the present method, if the area lies in the range 5 to 30% then there is excellent moisture permeability and suitable heat insulation.

(Action)

In accordance with the present utility model, with a single sheet of fabric it is possible to have an identical heat insulating capacity as a conventional multilayer structure. This is thought to be because the ceramic powder used in this utility model has the capacity to absorb solar radiation and then to convert and radiate it in the form of heat energy of wavelength 2 to 20 μm.

In the present utility model, there is merely affixed a resin which contains ceramic powder to the resin face of a moisture-permeable waterproof fabric, so no problems arise such as a lowering of the film strength of the resin layer on the moisture-permeable waterproof fabric or a lowering of the adhesive strength in terms of the base material.

Again, in the moisture-permeable waterproof fabric of the present utility model, since the ceramic powder-containing resin is present 'dotted-around' the entire face of a moisture-permeable waterproof resin film on

the surface of a base material comprising a woven or knitted material, the weight of the fabric as a whole is not increased much, and it is possible to provide a moisture-permeable waterproof fabric for clothing applications which is light, has an excellent heat insulating capacity and possesses a strong film coating.

(Examples)

Next, the method of producing the moisture-permeable waterproof fabric with heat insulating properties according to the present utility model is explained in specific terms by means of examples.

Example 1

Firstly, as the base material, a plain weave fabric was prepared comprising 70 denier/34 filament nylon yarns as both warp and weft yarns, and having a warp density of 120 per inch and a weft density of 90 per inch, and this fabric was subjected to scouring and dyeing with an acid dye by the usual methods, after which the fabric was subjected to padding (mangling factor 35%) with a 3% aqueous solution of the fluorine-based waterproofing agent emulsion Asahiguard 710 (product of Asahi Glass Co.), and then heat-treated for 1 minute at 160°C.

Next, using a calendaring machine with mirror-surface rolls, calendaring was carried out under conditions of temperature = 160°C, pressure = 30 kg/cm^2 and velocity 20 m/minute. Subsequently, the resin solutions shown in the following Formulations 1 and 2, and having a resin solids content of about 20%, were respectively applied *(to separate pieces of the calendared fabric)* at a

coverage of about 20 g/m^2 using a knife-over-roll coater, then immersion immediately performed for 1 minute in an aqueous solution at 15°C to coagulate the resin component. Thereafter, washing was performed for 10 minutes in warm water at 50°C and drying carried out.

[Formulation 1]

polyamino acid urethane copolymer (copolymerization ratio 1/1)	100 parts
Crisbon AW-7H (polyurethane resin produced by the Dainippon Ink & Chemicals Co.)	10 parts
Crisbon BL-50 (isocyanate compound produced by the Dainippon Ink & Chemicals Co.)	2 parts
Crisbon Assister SD-7 (non-ionic surfactant produced by the Dainippon Ink & Chemicals Co.)	3 parts
dimethylformamide	10 parts

[Formulation 2]

Crisbon 8114 (polyurethane resin produced by the Dainippon Ink & Chemicals Co.)	100 parts
Crisbon BL-50 (isocyanate compound produced by the Dainippon Ink & Chemicals Co.)	2 parts
Crisbon Assister SD-7 (non-ionic surfactant produced by the Dainippon Ink & Chemicals Co.)	3 parts
polyvinyl pyrrolidone (pore-former)	2 parts
dimethylformamide	10 parts

In this way, there were obtained a moisture-permeable waterproof polyamino acid urethane resin-coated fabric and a polyurethane resin-coated fabric.

Next, a mixture comprising 60% titanium dioxide, 38% silicon dioxide and 2% ferric oxide was sintered and then pulverized to a particle size of 10 μm or less, to produce a ceramic powder, and this ceramic powder was incorporated at a level of 60 wt% into a polyester-based linear polyurethane solution on a triple roll mill.

The ceramic powder-containing resin obtained was coated in the form of dots on the resin coated face of both of the aforesaid coated fabrics by screen printing at 20 mesh and an application area of 25%.

The dot-coated moisture-permeable waterproof fabrics were subjected to waterproofing under the same conditions as in the waterproofing treatment of the base material, and in this way two moisture-permeable waterproof fabrics with heat insulating properties according to the present utility model were obtained.

(Comparative Examples)

4 parts of aluminium powder (Comparative Example 1) or carbon powder (Comparative Example 2) was added to the aforesaid resin solutions of Formulation 1 and 2 respectively, and coating carried out therewith. Thereafter, excepting that no coating[i] was carried out with the ceramic powder-containing resin, moisture-permeable waterproof fabrics with aluminium powder incorporated in the resin layer were obtained in the same way as above.

The moisture-permeable waterproof fabrics obtained in the Examples and Comparative Examples were subjected to performance measurement and evaluation by the following methods and the results are shown in Table 1.

(1) Water pressure resistance: JIS L-1096 (low water pressure resistance method)

(2) Waterproofness: JIS L-1096 (spray method)

(3) Moisture-permeability: JIS L-1099 (method A-1)

(4) Heat insulation: Using a photographic 100W white light source as the energy source, the temperature rise of the fabric was measured in a constant temperature room at 20°C/60%RH, with a Thermoviewer (IR sensor, made by JEOL)

(5) Peel strength: JIS L-1089

(6) Rubbing resistance: Using a Scott type rubbing resistance tester, a load of 1 kg was applied under conditions of abrasion rate 120 per minute, and the number of abrasions (times) for the resin surface to be damaged was determined.

Table 1

	Formulation 1 (polyamino acid urethane moisture-permeable waterproof fabric)			Formulation 2 (polyurethane moisture-permeable waterproof fabric)		
	This Utility Model	Comp. Example 1	Comp. Example 2	This Utility Model	Comp. Example 1	Comp. Example2
Water Pressure Resistance (mm)	>2000	>2000	>2000	>2000	>2000	>2000
Waterproofness	100	100	100	100	100	100
Moisture Permeability ($g/m^2.h$)	324	334	366	147	140	158
Heat Insulation (°C)	25.8	24.3	26.1	25.9	24.0	25.9
Peel Strength (g/inch)	780	680	640	850	750	700
Rubbing Resistance (times)	1800	1700	1600	2200	2100	2000

It is clear from Table 1 that the moisture-permeable waterproof fabrics with heat insulation based on this utility model have outstanding water pressure resistance and moisture permeability and, furthermore, in terms of heat insulation too they are excellent and they are excellent in their resin layer film strength and adhesive strength to the base material.

(Effects of the Utility Model)

In this utility model, by evenly affixing, as dots, lines or combination of dots and lines, a ceramic powder-containing resin over the entire resin face of an ordinary moisture-permeable waterproof resin fabric, it is possible to obtain a fabric which, while retaining its outstanding moisture permeability and waterproofness, is also outstanding in terms of its heat insulation and resin layer film strength and adhesive strength to the base material.

On account of its excellent properties, the moisture-permeable waterproof fabric of the present utility model, which possesses heat insulation, is a material suitable for rain clothes and sports wear.

4. Brief Explanation of the Drawings

Figures 1 to 9 are all plan views showing the state with the ceramic powder-containing resin affixed in the form of dots and/or lines over the entire resin face of a moisture-permeable waterproof fabric. Figures 1 to 3 show dots; Figures 4 to 7 show lines; and Figures 8 and 9 show states having a combination of dots and lines.

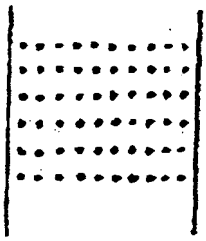

Figure 1

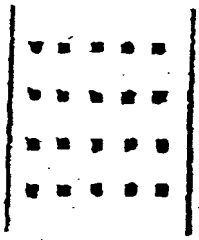

Figure 2

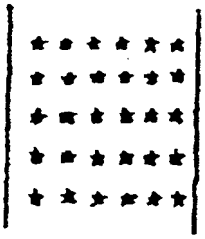

Figure 3

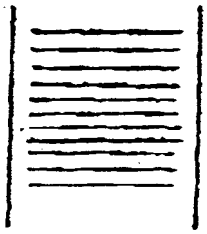

Figure 4

Figure 5

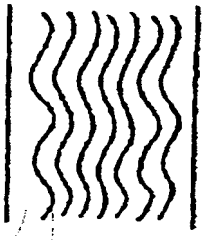

Figure 6

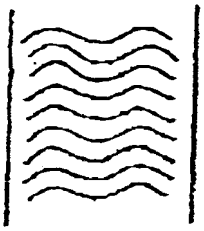

Figure 7

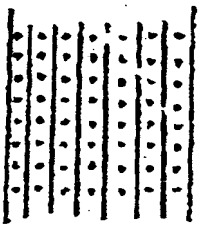

Figure 8

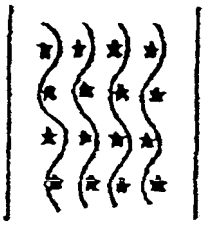

Figure 9

Translator's Note

[i] Presumably this means 'excepting that no affixing of the ceramic powder-containing resin was carried out'.